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groningen

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Data management

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Introduction

- Storage Infrastructures
  - Disk
  - Hierarchical Storage Management (HSM)
    - The hierarchy consists of different types of storage media, such as disks systems or tape, each type representing a different level of cost and speed of retrieval
    - policy-based management of file backup and archiving without the user needing to be aware of when files are being retrieved from or stored on backup storage media.

      Example: files that have not been used for some time are automatically migrated from disk to tape
    - HSM Software: TSM, DMF, CASTOR, Enstore, HPSS,…

Introduction

How do we link users, user programs and the data given the fact that data is distributed over different storage systems?

Introduction

Data management in the Grid environment needs:

1. A system which keeps track of the location of all files and copies of those files
2. A uniform interface for all storage systems

SRM

- Uniform access to heterogeneous storage resources on the Grid: SRM

- Storage Resource Managers
  - SRM is a control protocol for:
    - Space reservation
    - File management
    - Replication
    - Protocol negotiation

SRM

- SRM implementation
  - SRM I/F is implemented as a web service
  - Implementations for dCache, DPM, SRB, ...

- SRM Examples
  - srmLs
  - srmPrepareToPut
  - srmBringOnline
  - srmCopy
  - srmGetTransferProtocols

Storage Elements in gLite

- DPM
  - SRM – Collection of disk pools
  - Data Transfer protocols: gridftp, secure rfio, http(s)
  - Storage type: disk
- dCache
  - SRM – Collection of disk pools with tape backend
  - Data Transfer protocols: gridftp, gsidcap, xrootd, http(s)
  - Storage type: disk, HSM
- StoRM
  - SRM – Single large parallel file system with tape backend
  - Data transfer protocols: gridftp, file, http(s)
  - Storage type: disk, HSM

LFC

› LFC

- Keeps track of the location of copies (replicas) of files on the Grid

Name conventions

Logical File Name (**LFN**)

- An alias created by a user to refer to some item of data, e.g.

"lfn:/grid/tutor/mydir/myfile"

- Unix-like namespace

Globally Unique Identifier (**GUID**)

- A non-human-readable unique identifier for an item of data, e.g.

"guid:f81d4fae-7dec-11d0-a765-00a0c91e6bf6"

Site URL (**SURL**)

- The location of an actual piece of data on a storage system, e.g.

"srm://pcrd24.cern.ch/flatfiles/cms/output10_1"

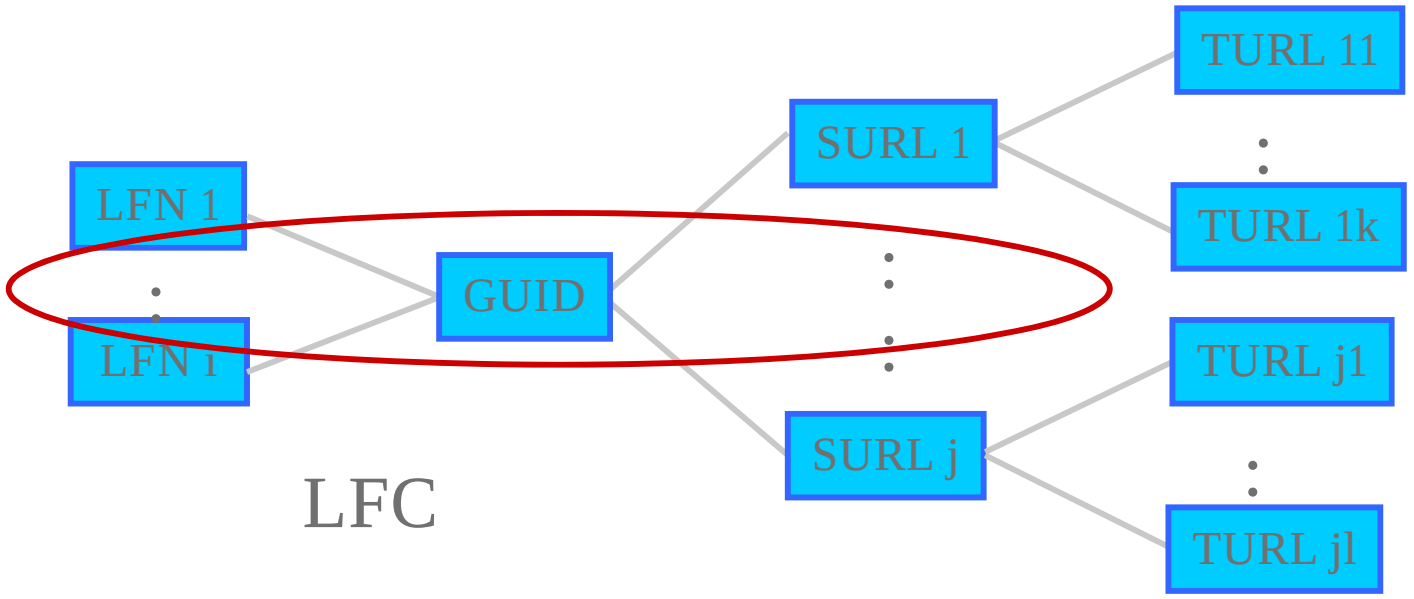
Transport URL (**TURL**)

- Locator of a replica + access protocol: understood by a SE, e.g.

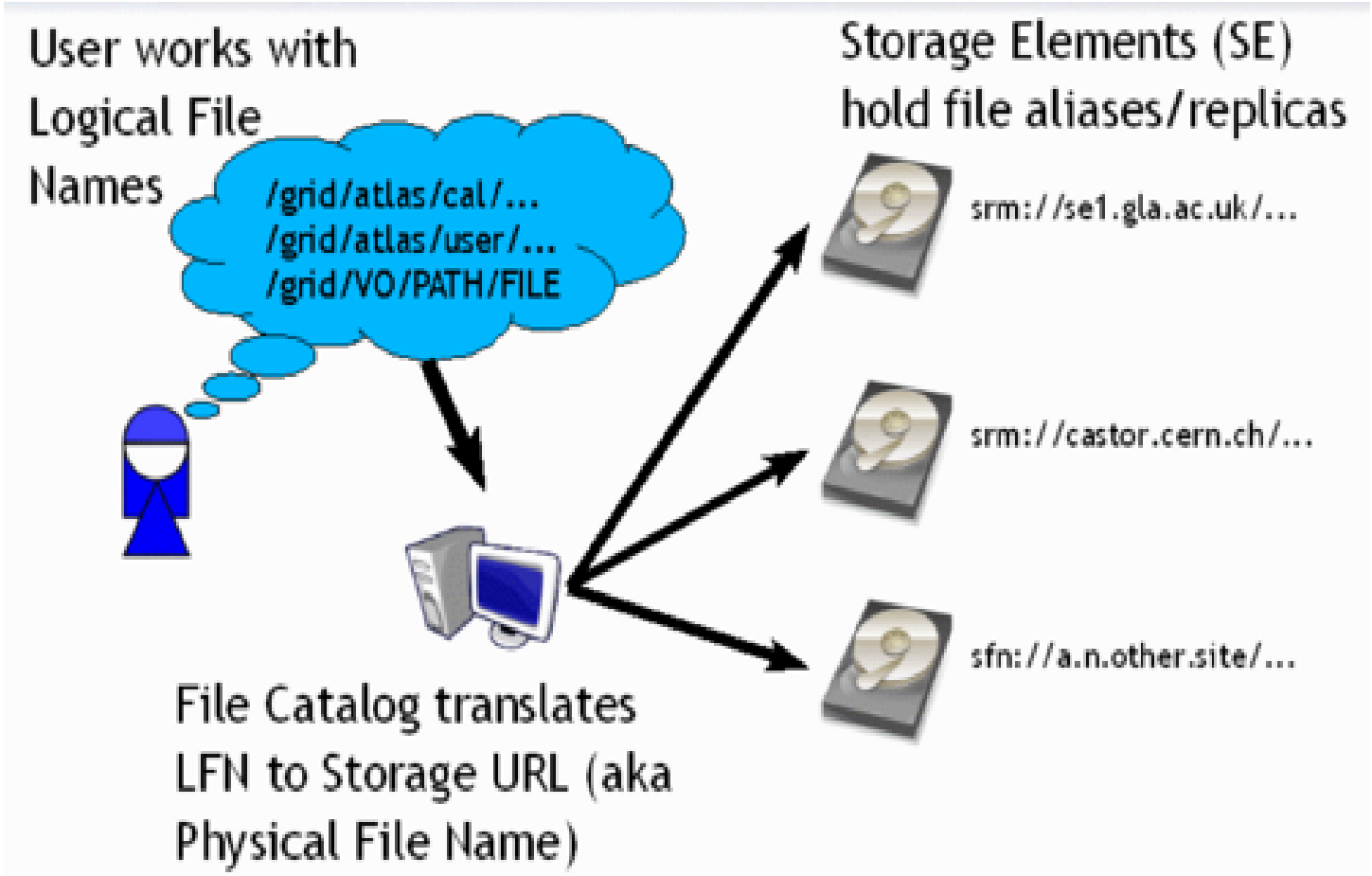
"rfio://lxshare0209.cern.ch//data/alice/ntuples.dat"

Naming conventions

› How do they fit together?
  • LFC holds the mapping LFN-GUID-SURL



LFC


User works with Logical File Names
/grid/atlas/cal/...
/grid/atlas/user/...
/grid/VO/PATH/FILE
Storage Elements (SE) hold file aliases/replicas
srm://se1.gla.ac.uk/...
srm://castor.cern.ch/...
sfn://a.n.other.site/...
File Catalog translates LFN to Storage URL (aka Physical File Name)

LFC interfaces

- Interaction with the WMS(RB)
  - The InputSandbox and OutputSandbox should only be used for small amounts of data. Large files should be on SEs
  - The RB can locate Grid files: allows for data-based match-making
  - Jdl file:
    - InputData = "lfn:/grid/tutor/MyFile";
      - The lfn's / guid's needed by the job as an input to the process
      - Tells RB to schedule job on CE close to SE holding the file
      - glite-brokerinfo getInputData returns list of files in InputData attribute
    - OutputSE=srm.grid.sara.nl";
      - location of a SE where the output data will be stored
    - DataAccessProtocol="gsiftp";
      - The list of protocols that the application is able to "speak" for accessing files listed in the InputData

LFC

- LFC interfaces
  - Commandline interface and C/C++/Python api
  - Lcg_utils commandline tools and API
    - Combined operations on LFC and data
  - GFAL
    - Provides a Posix-like interface for File I/O Operation

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Data Management CLIs & APIs

- lcg_utils: lcg-* commands + lcg_* API calls
  - Provide (all) the functionality needed by the LCG user
  - Transparent interaction with file catalogs and storage interfaces when needed
  - Abstraction from technology of specific implementations

- Grid File Access Library (GFAL): API
  - Adds file I/O and explicit catalog interaction functionality
  - Still provides the abstraction and transparency of lcg_utils

CLIs & APIs

lcg-utils commands: Replica Management

lcg-cp	Copies a grid file to a local destination
lcg-cr	Copies a file to a SE and registers the file in the catalog
lcg-del	Delete one file
lcg-rep	Replication between SEs and registration of the replica
lcg-gt	Gets the TURL for a given SURL and transfer protocol
lcg-sd	Sets file status to “Done” for a given SURL in a SRM request

lcg-utils commands: File Catalog Interaction

lcg-aa	Add an alias in LFC for a given GUID
lcg-ra	Remove an alias in LFC for a given GUID
lcg-rf	Registers in LFC a file placed in a SE
lcg-uf	Unregisters in LFC a file placed in a SE
lcg-la	Lists the alias for a given SURL, GUID or LFN
lcg-lg	Get the GUID for a given LFN or SURL
lcg-lr	Lists the replicas for a given GUID, SURL or LFN

Information system

Finding out where to put your data:

- BDII
  - BDII collects information of all nodes running grid services in the EGEE infrastructure.
  - Based on ldap
- Need to set environment variable LCG_GFAL_INFOSYS
  - Needs to be set to a BDII. Example: bdii.grid.sara.nl:2170

Information system

- lcg-infosites
  - Example: finding an SE:

> lcg-infosites --vo tutor se

```
Avail Space(Kb) Used Space(Kb)  Type    SEs
----------------------------------------------------------
1320000000      n.a             n.a     gb-se-ams.els.sara.nl
1320000000      n.a             n.a     gb-se-wur.els.sara.nl
536868064       2848            n.a     se.grid.rug.nl
104856555       1044            n.a     srm.grid.sara.nl
```

  - Example: finding an LFC

> lcg-infosites --vo tutor lfc

lfc.grid.sara.nl

Information system

› lcg-info

For more advanced searches:

For example, finding out where to put your files

```
>lcg-info --vo tutor --list-se --query='SE=srm.grid.sara.nl' --attrs=Path

- SE: srm.grid.sara.nl
  - Path              /pnfs/grid.sara.nl/data/tutor
```

Links

- gLite User Guide: https://edms.cern.ch/document/722398/
- dCache clients: http://www.dcache.org/manuals/Book-1.9.12/cookbook/cb-clients.shtml